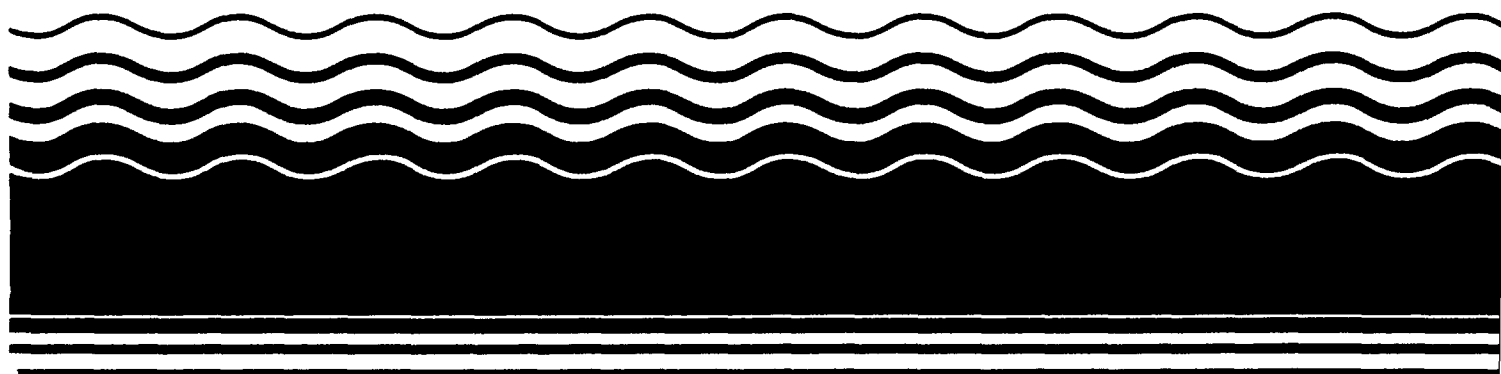


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Superfund Record of Decision:

Denver Radium (Operable Unit 9), CO



REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R08-92/062	2.	3. Recipient's Accession No.
4. Title and Subtitle SUPERFUND RECORD OF DECISION Denver Radium (Operable Unit 9), CO Eighth Remedial Action - Subsequent to follow		5. Report Date 12/23/91	
7. Author(s)		6.	
9. Performing Organization Name and Address		8. Performing Organization Rept. No.	
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12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. Type of Report & Period Covered 800/000	
15. Supplementary Notes PB93-964402		14.	
16. Abstract (Limit: 200 words) <p>The Denver Radium site is a former radioactive mining site located in Denver, Denver County, Colorado. The site includes a 17-acre former brick plant, a parking lot, and a large amount of exposed soil. Land use in the area is predominantly commercial and industrial, with a residential area located several blocks east of the site. The South Platte River lies 1,000 feet from the former brick plant. Industrial activities commenced at the site in 1886 with the construction of the Bailey Smelter. In 1890, the Gold and Silver Extraction Company began a cyanide leaching operation onsite. In 1901, the Bailey Smelter burned down. By 1903, the Colorado Zinc Company had constructed a mill on the site of the Bailey Smelter, and zinc milling operations continued until 1910. From 1914 to 1917, the U.S. Bureau of Mines operated a radium processing facility onsite, known as the National Radium Institute (NRI). Other onsite industrial activities included minerals recovery, manufacturing and servicing of storage batteries, treating and sacking of metallic ore insulation, oil reclamation, and landfilling. Robinson Brick Company (Robco) acquired 13.5 acres of the site in 1941 and a contiguous 3.5-acre parcel in 1951. Robco, the present owner</p> <p>(See Attached Page)</p>			
17. Document Analysis a. Descriptors Record of Decision - Denver Radium (Operable Unit 9), CO Eighth Remedial Action - Subsequent to follow Contaminated Medium: soil Key Contaminants: Metals (arsenic, lead, zinc)			
b. Identifiers/Open-Ended Terms			
c. COSATI Field/Group			
18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 48	
	20. Security Class (This Page) None	22. Price	

Abstract (Continued)

of the site, utilized the site until 1980 to manufacture bricks. In 1983, EPA discovered that 30 properties, including the Robco property, contained radiologic contamination in the soil attributable to prior NRI operations. In 1988, the U.S. Bureau of Mines initiated excavation of the radiologically contaminated material. In the course of the radium cleanup, metals contamination, resulting from mining wastes disposed of and used as fill from the mid-1880's to the early 1920's, was discovered onsite. Excavation of the radiologically contaminated materials was completed in 1991 as part of OUs 4 and 5. This ROD addresses approximately 16,500 cubic yards of metal-contaminated soil as OU9, the 9th of 11 OUs planned for the site. The primary contaminants of concern affecting the soil are metals, including arsenic, lead, and zinc.

The selected remedial action for the site includes constructing a 3.7-acre multi-media cap over onsite contaminated soil with metal concentrations exceeding action levels; utilizing the existing concrete floor of the brick plant and asphalt parking lot in concert with the backfilled soil cap; providing inspection and repair of the concrete floor, as necessary; upgrading the asphalt with geotextile fabric and an additional 6-inch layer of asphalt; monitoring downgradient ground water; long-term monitoring to ensure effectiveness of the cap; and implementing institutional controls including deed restrictions to limit the ground water use and to maintain the integrity of the cap. The estimated present worth cost for this remedial action is \$1,702,000.

PERFORMANCE STANDARDS OR GOALS: Design of the cap will comply with RCRA and state requirements. Chemical-specific soil remediation goals, which are based on health criteria, include prevention of exposure and direct contact with action level concentrations exceeding arsenic 79 ug/l; lead 1,000 ug/l; and zinc 17,000 ug/l.

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Denver Radium, Operable Unit 9
Robinson Brick Company Property

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Declaration for the Record of Decision

Site Name and Location

Denver Radium Site, Operable Unit 9
Denver, Colorado

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Denver Radium Site, Operable Unit 9, in Denver, Colorado, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the basis and purpose of the selected remedy for this Site.

The State of Colorado concurs on the selected remedy. The information supporting this remedial action decision is contained in the administrative record for the Site.

Assessment of the Site

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial danger to public health, welfare, and the environment.

Description of the Remedy

The Denver Radium Site consists of eleven operable units throughout the City and County of Denver which were contaminated as a result of several minerals processing operations. The Operable Unit (OU) 9 property, located at 500 South Santa Fe Drive, has previously been remediated for radiological contamination. The selected remedy presented in this ROD addresses metals contamination in the soils. Direct contact with, or inhalation or ingestion of metals-contaminated soils have been determined to pose the principal threat to human health. The function of this final response action at the OU is to permanently reduce the risks associated with metals contamination in the soils by creating a barrier between contaminated soils and any potential human receptors. No environmental receptors were identified.

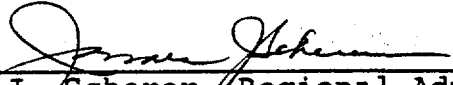
The major components of the remedy include:

- Capping the metals-contaminated soils;
- Conducting environmental monitoring to ensure the effectiveness of the remedial action; and
- Implementing institutional controls to 1) limit use of groundwater at the Site, and 2) maintain the integrity of the cap.

Declaration

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this Site. However, because treatment of the principal threats at the Site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment. While treatment would reduce the mobility of the contaminants, there would be no significant increase in protectiveness to human health and the environment over the selected capping remedy.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review of the remediation will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

 12/23/91
James J. Scherer, Regional Administrator
Region VIII, Environmental Protection Agency

Denver Radium, Operable Unit 9
Robinson Brick Company Property

Decision Summary for the Record of Decision

I. Site Name, Location and Description

Operable Unit (OU) 9 of the Denver Radium Site is located in the south-central part of Denver, Colorado at 500 South Santa Fe Drive, near the intersection of West Alameda Avenue and Interstate 25. The 17 acre OU, referred to in this document as the "Site", consists of the Robinson Brick Company (Robco) property. It is bounded on the west by a frontage road adjacent to Interstate 25, on the east by the main north/south rail corridor owned by the Denver & Rio Grande Western Railroad, and on the south by the U.S. Welding Company property. To the northwest is a vacant Regional Transportation District (RTD) facility. (See Figure 1-1.)

The abandoned brick plant and a few small structures are presently standing at the Site. An asphalt parking lot is located adjacent to the brick plant. However, the Site is mostly undeveloped. Commercial and industrial land uses dominate the area surrounding the Site. The nearest residential population is located several blocks east of the Site.

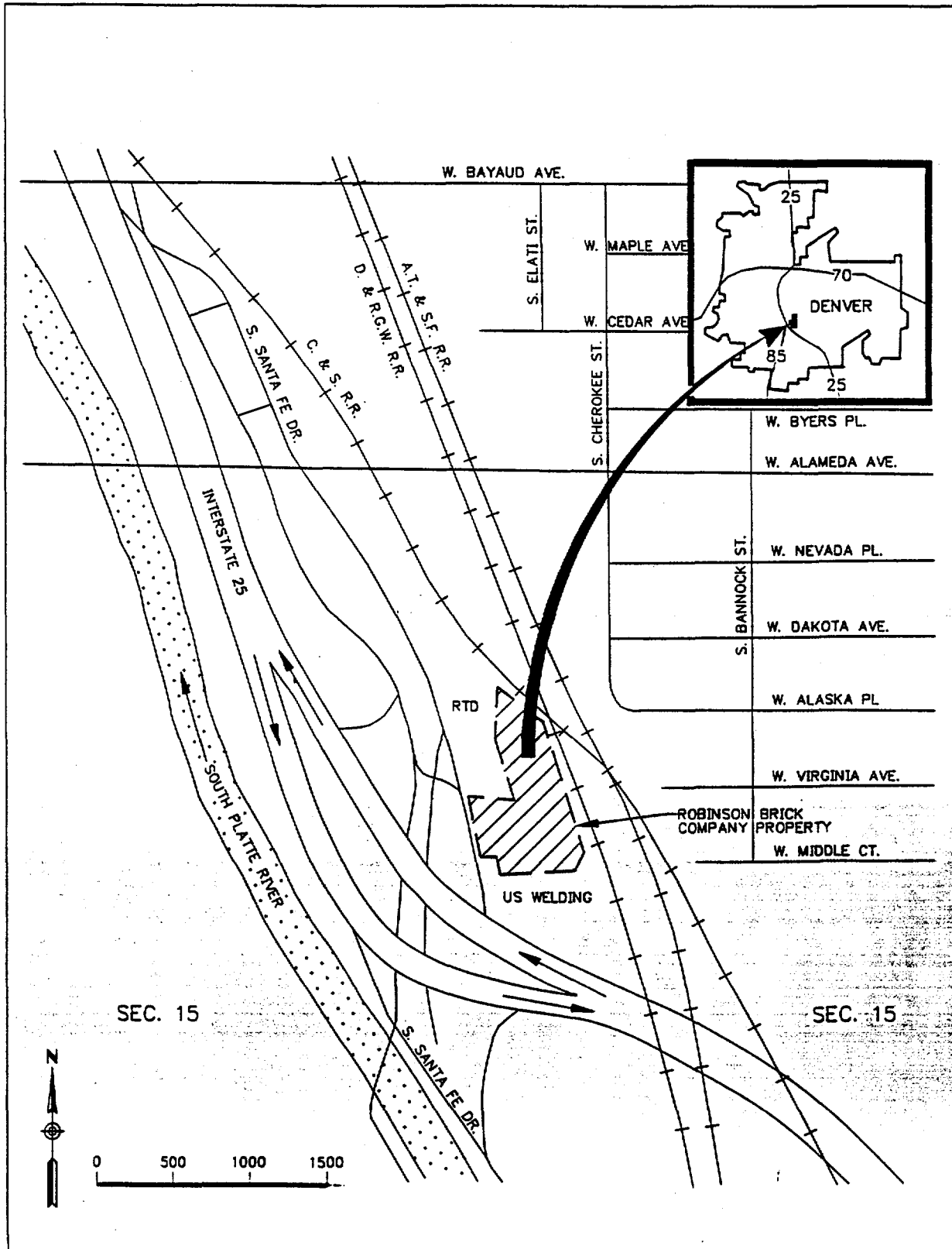
The Site slopes gently to the West toward the South Platte River which is about 1000 feet from the Robinson Brick Company property boundary. The Site does not lie within a flood plain. Ground water at the Site is found in the alluvium at depths of 10 to 20 feet below ground surface. There is no current use of ground water at the Site.

II. Site History and Enforcement Activities

History of Operations

Industrial activity at the Site began in 1886 with the construction of the Bailey Smelter. The Bailey Smelter appears to have operated only sporadically in the late 1880's. In 1890, the Gold & Silver Extraction Company began a cyanide leaching operation at the Site using the McArthur Forrest Chemical Cyanide Process. In 1901, the Bailey Smelter burned down. By 1903, the Colorado Zinc Company had constructed a mill on the Site of the old Bailey Smelter. Zinc milling operations continued until about 1910. From 1914 to 1917, the U.S. Bureau of Mines operated a Radium processing facility (the National Radium Institute) on Site. Other industrial activities at the Site have included minerals recovery, manufacturing and servicing of storage batteries, treating and sacking of metallic ore insulation, oil reclamation, and landfiling. In 1941, the Robinson Brick Company acquired 13.5 acres of the Site and in 1951 acquired an

FIGURE 1 - 1
Location Map of Operable Unit 9



additional 3.5 contiguous acres and manufactured bricks on the Site until 1980. The Robinson Brick Company is the present owner of the Site.

Past Site Investigations and Superfund Activities

In 1979, research by EPA led to the rediscovery of the former National Radium Institute (NRI). By 1983, thirty properties, including the Robco property, were found to have radiologic contaminants in the soils and were placed on the National Priorities List for Superfund cleanup. Due to their association with the NRI, the U.S. Bureau of Mines was named as a responsible party for the radiologic contamination at OU 9 and the Bureau has agreed, pursuant to a Memorandum of Understanding, to pay for the radiologic clean up at the Site. In May 1988, excavation of the radiologically contaminated soils at OU 9 began. In September of that year, during the course of the radium cleanup, metals contamination was discovered on Site. An investigation to characterize the nature and extent of metals contamination was conducted in 1989 and 1990. The investigation resulted in a feasibility study (July 1991) outlining a number of alternatives for the cleanup of approximately 16,540 cubic yards of metals-contaminated soils remaining in place on the Site. (Excavation of the radiologically contaminated materials was completed in March 1991 as part of operable units 4 and 5.)

III. Highlights of Community Participation

The Focused Feasibility Study (FFS) and the Proposed Plan for Operable Unit 9 of the Denver Radium Site were released to the public for comment on August 2, 1991. These two documents were made available to the public in the Administrative Record maintained at the Central Branch of the Denver Public Library and at the EPA Region VIII Superfund Records Center in Denver, Colorado. The notice of availability for the Focused Feasibility Study, the Proposed Plan, and other documents in the Administrative Record was published in the Denver Post on August 2, 1991. The initial public comment period was held from August 2, 1991 to September 3, 1991. Upon timely request, the public comment period was extended for 30 days to October 3, 1991. A public meeting was held in Denver on August 14, 1991 to allow the public an opportunity to provide comments on the Proposed Plan and to ask questions of representatives of EPA and the Colorado Department of Health about the Site and the remedial alternatives under consideration. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

This decision document presents the selected remedial action for Operable Unit 9 of the Denver Radium Site, in Denver, Colorado chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Contingency Plan. The decision for this Site is based on the Administrative Record.

IV. Scope and Role of Operable Unit Within Site Strategy

Operable Unit 9 is one of eleven operable units which comprise the Denver Radium Site. The Denver Radium Site was divided into separate units since the contaminated material was found in discrete locations within the City and County of Denver. The Robco property and adjacent railroad right-of-way property have already been remediated for radiologic contamination as part of operable units 4 and 5. This Record of Decision, for OU 9, addresses metals contamination on the Robco property. Records of Decision have been signed for each of the other OUs of the Denver Radium Site with the exception of OU 8.

V. Summary of Site Characteristics

Source and Nature of Contamination

In the Site characterization program, forty-nine boreholes were driven on the Site to sample the soils. The data from the borehole samples shows that contamination of the soils by arsenic, lead, and zinc is largely confined to the fill material. The data also shows that no metals contamination for arsenic, lead or zinc extends into the bedrock or the soils below the water table. Two conclusions were drawn from this data. First, the fill material is the source of the metals contamination on the Site. Based on the history of industrial operations at the Site, EPA determined that the metals contamination resulted from mining wastes disposed and used as fill from the mid-1880s to the early 1920s. The second conclusion reached by EPA is that the metals contamination is not migrating significantly from the contaminated fill material into the alluvium or the bedrock.

Groundwater is encountered at ten to twenty feet below the surface. Cadmium, lead, and zinc concentrations, in excess of the Federal drinking water standards, have been found associated with isolated pockets of low pH groundwater found on the Site. These isolated areas are probably the result of early minerals processing operations on the Site. The distribution of the contaminants indicates that they are not extremely mobile in the alluvial aquifer ground water. Based on the available hydrological data, it was concluded, in the characterization study, that the contaminant concentrations appear to be controlled locally by the ground water pH. Where pH values are low, contaminant concentrations are elevated. As contaminated ground water migrates away from areas of low pH on the Site toward areas of higher pH, the reaction causes the contaminants to come out of solution.

Extent of Contamination

Distribution of the metals of concern on-site is described below:

- Arsenic generally occurs at the Site in high concentrations along with lead. Background concentration of arsenic in the subsurface is approximately 2 parts per million (ppm). The maximum value for arsenic in soil samples analyzed is 490 ppm.
- Lead is generally elevated in samples from fill material across the Site. Background concentration of lead in the subsurface is approximately 30 ppm. The maximum value for lead in soil samples analyzed is 35,800 ppm.
- Zinc is also generally elevated in samples from fill material. Elevated concentrations are seen in some samples that do not have high cadmium and lead concentrations. Background concentration of zinc in the subsurface is approximately 50 ppm. The maximum value for zinc in soil samples analyzed is 32,050 ppm.

Based on the risk assessment, action levels were defined for each metal of concern. Concentrations of metals which exceed these levels would pose an unacceptable health risk. Based on the available data, an estimated 16,540 cubic yards of soils are contaminated with metals above the action levels. The affected area was determined to be approximately 4.8 acres.

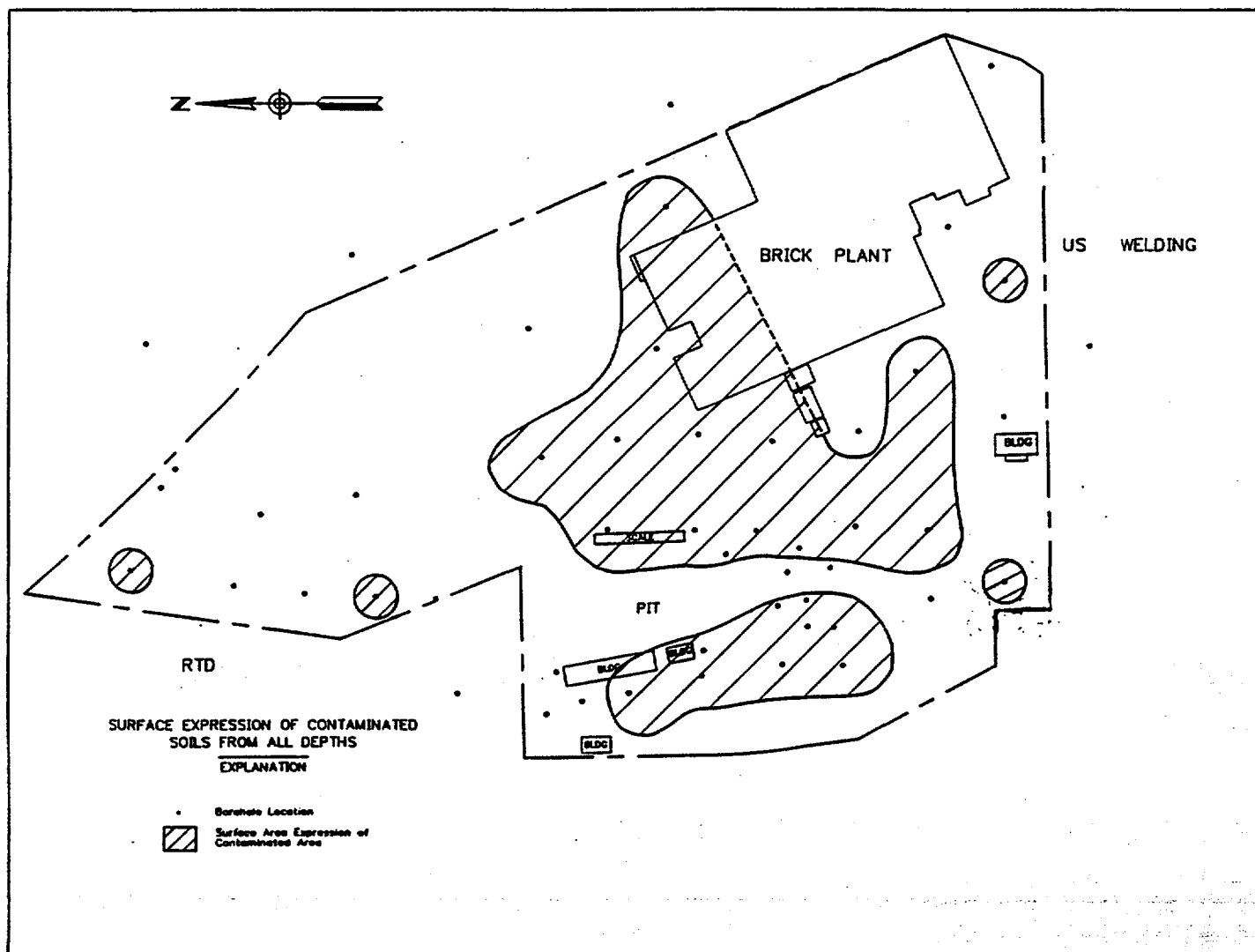
The areal extent of the fill material contamination is illustrated in Figure 5-1, "Areal Distribution of Metals Contamination at OU 9". The contaminated areas are presented as a large central body with four small isolated outliers. The large central area can be divided into three separate subareas:

- | | | |
|--|---------------------|-----|
| 1. Contaminated Area under Brick Plant | 27,000 square feet | 13% |
| 2. Contaminated Area under Parking Lot | 45,000 square feet | 22% |
| 3. Contaminated Area of Exposed Soil | 130,000 square feet | 63% |

Total Contaminated Area	202,000 square feet	98%
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The remaining 5,000 square feet or 2 percent is accounted for by the four outliers. The four small isolated outliers represent single detections above the action level and can be divided into two groups. Two of the outliers are to the north of the main body of contaminated soil along the western boundary of the Site and represent surface contamination. The other two isolated outliers are south of the main body of contaminated soil. These last two outliers are each based on a single detection of metal contamination at four and fourteen feet below clean soils.

FIGURE 5 - 1
Areal Distribution of Metals Contamination at OU 9



Potential routes of contaminant migration and population and environmental areas that could be affected by the contaminants are described in Section VI.

VI. Summary of Site Risks

As part of the Characterization of Selected Metals study, EPA prepared a Baseline Risk Assessment for the Robco Site in July 1990. This risk assessment was conducted to characterize, in the absence of remedial action (i.e., the "no-action" alternative), the current and potential threats to human health and the environment that may be posed by contaminants at the Site.

HUMAN HEALTH RISKS

Contaminants and Site Media

Exposure pathways were identified and analyzed for ground water, surface water, soils, and air media at the Site. It was concluded in the risk assessment that only direct contact with, or inhalation or ingestion of soils, could result in significant health risks. Of the contaminants studied in the Baseline Risk Assessment, the following metals were determined to be the primary contaminants of concern in the soils:

- Arsenic due to potential carcinogenic and non-carcinogenic health effects in humans;
- Lead due to potential non-carcinogenic and carcinogenic health effects in humans; and
- Zinc due to potential environmental effects and non-carcinogenic health effects in humans.

Other metals (chromium, cadmium, copper, and selenium) that were detected on the Site were not present in concentrations which would pose any significant environmental or public health threats.

Exposure Assessment

The major exposure routes that lead to public health threats are inhalation of dusts, incidental ingestion of soils and dusts, and direct skin contact with soils and dusts. Ingestion of contaminated ground water is not a significant exposure route due to past, present, and likely future land use (highways, railroad rights-of-way and industrial properties), the availability of municipal water supplies, and the low potential for migration of the contaminants from the Site.

To analyze potential risks to human health, the baseline risk assessment evaluated various scenarios to establish

potential risks associated with alternate uses of the Site. One current and three future land-use scenarios were considered. Of the four scenarios considered, EPA concluded that metals contamination could pose a health risk in the following three scenarios:

Current land-use scenario:

- 1) Children trespassing onto the Site.

Future land-use scenarios:

- 2) Construction workers involved in a short duration construction project. New construction would require cleaning, scraping, and shallow excavating at the Site. Laborers are the construction workers closest to the metals-contaminated soil.
- 3) Children residing in a subdivision constructed on Site. This scenario examines potential health effects on children who have spent five years (i.e., between the ages of one and six) in the subdivision.

The fourth scenario, industrial workers, was not evaluated further since the associated carcinogenic and non-carcinogenic health risks were determined to be negligible. EPA determined that the scenario involving children residing in a subdivision constructed on the Site would not be considered further due to the current and potential future use of the Site. Given the long industrial history at the ROBCO Site and its location between Interstate 25 and a major rail corridor, it is unlikely that the property would ever be converted to residential use. Therefore, only the first two scenarios were considered in determining action levels for metals in soil.

Current Risks

The baseline risk assessment shows that children trespassing on the Site could be at risk for unacceptable non-carcinogenic health threats due to arsenic and zinc. In particular, dermatotoxic effects may result due to combined ingestion and direct contact with arsenic-contaminated soils. Skin irritation resulting from direct contact with acidic salts of zinc is also possible. The risk assessment indicates that blood lead levels in children could become elevated.

Future Potential Risks

According to the risk assessment, construction workers involved in a short duration (1 year) construction project could be at risk for both carcinogenic and non-carcinogenic health threats due to arsenic exposure. Dermatotoxic effects may result

from cumulative exposure to arsenic via the ingestion and direct contact routes.

Toxicity Assessment

The toxicity of chemicals is evaluated in terms of carcinogenicity and other, non-carcinogenic effects. Cancer potency factors for carcinogenic chemicals and reference doses for non-carcinogenic chemicals are used to evaluate risks posed by the exposure to chemicals. (Table 5.5 of the Baseline Risk Assessment summarizes the cancer potency factors and the reference doses for contaminants of concern.)

The cancer potency factor for a given compound is multiplied by the estimated dose to obtain the carcinogenic risk estimate. The individual risks from each compound in a particular exposure pathway are then summed to obtain an estimate of the overall carcinogenic risk posed. (At this Site, carcinogenic risk is posed only through the inhalation pathway.) The acceptable carcinogenic risk range is between $1E-04$ and $1E-06$. The baseline risk assessment shows that the cumulative carcinogenic risk at the Site for the current land-use scenario is $3.8E-07$. For the future land-use scenario, the cumulative carcinogenic risk is $2.6E-04$. The carcinogenic risk associated with this scenario is just above the upper threshold that would justify a response action. While lead has been identified as a probable human carcinogen, no potency factors have been established. Until a potency factor has been developed and approved, the interim guidance on soil lead cleanup has set an action level in the range of 500 to 1000 parts per million (ppm). EPA selected an action level of 1000 ppm for the Robco property given the industrial nature of the area. (See the Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites, OSWER Directive 9355.4-02, September 7, 1989.)

Reference doses (RfDs) indicate the potential for adverse health effects caused by exposure to contaminants exhibiting non-carcinogenic effects. The RfD for a given compound is divided into the estimated dose to obtain the hazard quotient (HQ). The HQs for each compound in a particular pathway are then summed to obtain a hazard index (HI), which is the estimate of the overall non-carcinogenic risk. A reference dose has not been determined for lead, although guidance suggests that acceptable levels for lead in soils are between 500 and 1000 parts per million (ppm).

Risk Characterization

The non-carcinogenic risks for all contaminants associated with children trespassing on Site are presented in Table 6-1. The risks presented are based on levels of contamination with no remediation. For arsenic, the HI is 2.7, for zinc the HI is 1.2. An HI over 1.0 indicates that there may be a risk posed by the

exposure to non-carcinogenic compounds. As indicated above, there is no RfD for lead and thus no HI can be calculated.

Table 6-1 also shows the non-carcinogenic risks associated with an on-site construction worker population. For this scenario, the HI for arsenic is 1.4 indicating that there may be a risk posed by exposure to arsenic.

TABLE 6-1

Noncarcinogenic Hazard Evaluation

<u>Children Trespassing</u>	Arsenic	Zinc
Ingestion HI	5.7E-01	3.2E-01
Direct Contact HI (soils)	2.1	9.0E-01
Direct Contact HI (runoff)	1.5E-10	1.8E-07
Cumulative HI	2.7	1.2
<u>Construction Worker</u>		
Ingestion HI	5.3E-01	3.0E-01
Direct Contact HI (soils)	8.2E-01	3.6E-01
Cumulative HI	1.4	6.6E-01

Based on the exposure pathway analysis, the estimated dose of metals that persons could receive, and the toxicity of each of the metals, action levels for each metal were calculated. These action levels define the concentrations above which the health risks are unacceptable. The additive risks of arsenic and zinc were taken into consideration in setting the action levels. The cleanup goal for arsenic will serve to reduce the estimated incremental risk of cancer for the construction worker to acceptable levels. Table 6-2 summarizes the action levels.

Table 6-2

Action Levels for Metals of Concern at Robco OU 9

Metal	Value (ppm)
Arsenic	79
Lead	1000
Zinc	17,000

ENVIRONMENTAL RISKS

The ecological effects due to contamination at this Site are not expected to be significant since this industrialized area does not provide a habitat for wildlife, and ground water modeling shows that contaminated ground water on the Site would have no adverse impact on the water quality in the nearby South Platte River. None of the modeled mixing zone predictions are above the ambient water quality criteria and data suggests that ground water contamination is limited to local ground water cells that have low pH.

CONCLUSION

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. The hazardous nature of this Site is illustrated by the values presented in Table 6-1. Risks are associated with inhalation, ingestion, and/or direct contact with contaminated soils at the Site for the potential exposure pathways identified in the Baseline Risk Assessment. Elevated lead levels are also of concern at the Site since lead has been identified as a probable human carcinogen and lead could result in adverse noncarcinogenic toxic effects. Remediation of the Site by capping metals-contaminated soils with at least two feet of clean soil as described in this ROD will result in risks which are within the acceptable range as established by the NCP. Non-carcinogenic risks will be reduced so that the Hazard Index is no greater than 1, and carcinogenic risks will be reduced to a range no greater than $1E-04$ to $1E-06$.

VII. Description of Alternatives

The Focused Feasibility Study was conducted to develop and evaluate alternatives for metals-contaminated soils at the Site. Remedial action objectives were first identified on the basis of the Site characterization results and the risk assessment. Next, a range of response actions were assembled from remedial technology process options to meet these objectives. The response actions and technologies were screened based on effectiveness, implementability, and cost. Those which passed the initial screening were then combined into remedial action alternatives. Finally, the remedial action alternatives were screened in detail using the nine criteria required by the NCP. Following the detailed screening, five remedial alternatives remain. These alternatives include no action, as required by the NCP, two containment options, excavation with off-site disposal, and an on-site treatment and disposal alternative.

The alternatives presented in the Focused Feasibility Study report are summarized below:

Alternative 1 - No Action

The no action alternative provides the baseline for comparing other alternatives. This alternative would not involve any removal, containment or treatment of the contaminated soils. The Site would be left in the same condition as it presently exists. However, it would include periodic ground water monitoring.

Because this alternative would result in contaminants remaining on Site, CERCLA would require that the Site be reviewed every five years. The 30-year present worth for Alternative 1 is \$174,300. Implementation time for this remedy would be negligible.

Alternative 2 - Capping with Clay, Soils, Existing Structures and Institutional Controls (clay cap)

This alternative is conceived as a multi-media cap utilizing the existing concrete floor of the brick plant and the asphalt parking lot in concert with an engineered clay and soil cap. Of the 4.8 acres of contaminated soils on the Site, 3.7 acres would be capped with clay and soil; the remaining area would be covered by the existing structures. The concrete floor of the plant would be inspected and repaired, if necessary, for long-term stability and to minimize maintenance costs. The asphalt parking lot would be upgraded to minimize future maintenance costs by using geotextile fabric and an additional six-inch layer of asphalt. Fill material would be used to backfill the pit created by previous remedial activities. For those portions of the Site that are not covered by concrete or asphalt, a combination clay and soil cap would be built over the areas that are contaminated above the action levels. The two outliers to the north of the main area of contamination would be left in place and capped with clay and soil. The two outliers to the south of the main area of contamination are already covered by at least four feet of clean material and would be left in place without additional capping. The ground would be graded to provide appropriate drainage of precipitation and compacted to form the foundation for the cap. A two-foot thick layer of clay would be laid down in several lifts and compacted to design specifications.

Upon completion of the clay layer, an additional two-foot layer of clean fill would be added. The final step in completing the cap would be re-vegetating the area to provide long-term stability.

Certain State and Federal technical requirements (including RCRA) concerning grading, fill, compaction, and completion of a

cap were identified as applicable or relevant and appropriate requirements. The cap would be designed to meet all of these ARARs. During the construction phase, appropriate measures would be taken to control fugitive dust to assure compliance with the provisions of the Colorado Air Quality Control Act identified as ARARs.

Following construction of the cap, long-term maintenance, ground water monitoring, and institutional controls would be instituted. The long-term maintenance would consist of a plan for periodic inspections to assure the integrity of the cap with contingencies for repair, if needed. Ground water down-gradient of the Site would be periodically monitored to verify that contamination does not reach the South Platte River in detrimental concentrations. The institutional controls would consist of the placement of deed restrictions on the Site to prevent use of the Site for non-industrial/commercial purposes and to prevent uses of the capped area that could compromise the integrity of the cap.

As extra precautionary measures, EPA would require deed restrictions to prohibit placement of any wells on the Site for the purpose of supplying drinking water and would present to the City and County of Denver a proposal to zone the Site to control uses of the capped portions of the Site. If a zoning proposal can be agreed upon, presented to the City Council, and approved, such zoning may be used in concert with the deed restrictions or if EPA determines that the zoning is adequate and effective, EPA may allow the deed restrictions to be removed.

Any contaminated soils that were excavated as the result of future development of the Site would be disposed at a RCRA Subtitle C permitted facility. This disposal method would be used to insure overall protectiveness.

Because this alternative would result in contaminants remaining on-site, CERCLA would require that the Site be reviewed every five years. The 30-year present worth value for Alternative 2 is \$2,656,000. It would take approximately 6 weeks to implement this remedy.

Alternative 3 - Capping with Soil, Existing Structures and Institutional Controls (soil cap)

Alternative 3, the preferred alternative, is designed to make use of the existing concrete floor of the brick plant, asphalt parking lot and a cap of backfilled soil. As in Alternative 2, the concrete floor would be inspected and repaired, if required, and the asphalt would be upgraded to ensure long-term stability. Fill material would be used to backfill the pit created by previous remedial action. The soil cap would cover approximately 3.7 acres of the Site (where metals

contamination in the soil exceeds action levels) with a minimum of two feet of fill including six inches of soil which is adequate to support shallow rooted plants. The outliers to the north of the large area of contamination would remain in place and be covered with at least two feet of clean soil. The outliers to the south of the large area of contamination are already covered with over two feet of clean soil and would remain in place without additional cover. The design specifications prepared during the remedial design phase would be met.

As in Alternative 2, certain State and Federal technical requirements for caps were identified as ARARs. All construction and related activities would be conducted so as to meet these ARARs. Appropriate measures would be implemented during construction to control fugitive dusts to assure compliance with the provisions of the Colorado Air Quality Control Act identified as ARARs.

Long-term maintenance and institutional controls, including the extra precautionary measures, would be identical to those described for Alternative 2. Any contaminated soils that were excavated as the result of future development of the Site would be disposed at a RCRA Subtitle C permitted facility. This disposal method would be used to insure overall protectiveness.

Because this alternative would result in contaminants remaining in place, CERCLA would require that the Site be reviewed every five years. The 30-year present worth for Alternative 3 is \$1,702,000. The estimated implementation time is three weeks.

Alternative 4 - Excavation, Off-Site Disposal and Limited Institutional Controls (excavation with off-site disposal)

This alternative would achieve a complete removal of all the contaminated soils above the action levels by excavating the soils and transporting them to an off-site disposal site. After demolition of the small buildings and partial demolition of the other structures, the remedy would remove approximately 16,540 cubic yards of contaminated soil which would be loaded into bulk hauling trucks. The soil would then be taken to the nearest RCRA Subtitle C permitted facility for disposal. Other debris would be disposed at a local permitted landfill. Approximately 50,000 cubic yards of clean overburden would be moved and stockpiled on uncontaminated areas of the Site to allow access to the metals-contaminated soils. The clean overburden would later be used as fill to regrade the Site. Approximately 30,000 cubic yards of additional fill would be needed to complete the re-grading.

Although the contaminated soils are not regulated under RCRA because they are classified as mining wastes which are exempted

by the mining waste exclusion, the remedy would include disposal at a RCRA Subtitle C permitted facility. This disposal method would be used to insure overall protectiveness. In addition, a determination of acceptability under EPA's off-site policy (OSWER Directive 9834.11, November 13, 1987) would have to be secured prior to shipment of contaminated material off-site.

Following completion of the excavation and shipment of the contaminated soils and regrading of the Site, appropriate institutional controls would be initiated. No contaminated soils would be left on-site. Therefore, deed restrictions and/or city zoning provisions on use of the Site and inspection and maintenance actions would not be included in this alternative. Five-year reviews, as required by CERCLA, would be included because contaminants would be present in the ground water above health based levels. Periodic ground water monitoring would be conducted to measure attenuation of any contamination in the ground water. A prohibition against installation of wells for drinking water supply would also be included until the water quality was shown to meet all primary maximum contaminant levels (MCLs).

The thirty-year present worth of this alternative is estimated at \$10,392,200 with an implementation time of approximately 12 weeks.

Alternative 5 - Excavation, Solidification/Stabilization,
On-Site Disposal and Institutional Controls
(solidification)

This alternative would utilize a treatment technology to immobilize the metals in the soils by mixing the soils with fixation agents such as fly ash or concrete to form a solid mass. Limited demolition of existing structures would be required to gain access to the contaminated soils. The alternative would require the excavation of about 16,540 cubic yards of contaminated soils that would then be mixed with water and fixation agents. The resultant product would be poured into two-foot by two-foot by four-foot forms. Once the material was solidified, the solid blocks would be removed from the forms and allowed to cure. After the blocks had cured, they would be placed in the excavated areas and covered with soil. Because the treatment process would increase the volume of the waste by adding water and fixative agents, additional areas of the Site would be excavated for deposition of the blocks. All disposal cells would be designed to meet the Colorado requirements for solid waste landfills. After the treated materials had been disposed and covered with soil as in Alternative 2, the area would be revegetated.

During the excavation of soils, operation of the treatment facility, and placement of the treated materials, appropriate

measures would be taken to assure that fugitive dusts were controlled to comply with the provisions of the Colorado Air Quality Control Act.

Following completion of treatment and disposal, long-term maintenance, ground water monitoring, and institutional controls would be instituted as described in Alternative 2. The estimated total present worth of the construction, treatment costs and the associated O&M for this alternative is \$9,912,000 with an implementation time of 8 to 12 weeks.

VIII. Comparative Analysis of Alternatives

The remedial alternatives developed in the FFS were analyzed in detail using the nine evaluation criteria required by the NCP. These criteria are: 1) overall protection of human health and the environment; 2) compliance with applicable or relevant and appropriate requirements (ARARs); 3) reduction of toxicity, mobility, or volume through treatment; 4) long-term effectiveness and permanence; 5) short-term effectiveness; 6) implementability; 7) cost; 8) state acceptance, and 9) community acceptance. Criteria 1 and 2 are threshold criteria which must be met by the selected remedial action alternative. Criteria 3, 4, 5, 6 and 7 are balancing criteria. The final two criteria are modifying criteria used to evaluate the alternatives based on State and local concerns.

The strengths and weaknesses of the alternatives were weighed to identify the alternative providing the best balance among the nine criteria. A discussion of the comparative analysis of alternatives is discussed below.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

All of the alternatives analyzed (with the exception of No Action) would provide overall protection of human health and the environment by controlling, or eliminating the risks posed by direct contact with, or inhalation or ingestion of metals-contaminated soils. Alternatives 2 and 3 (capping) would control or eliminate Site risks by using a combination of engineering controls, capping, and institutional controls. Alternative 4 (off-site disposal) would eliminate the Site risks by excavation and off-site disposal of the contaminated soils at a RCRA Subtitle C permitted landfill. Alternative 5 (solidification) would control or eliminate Site risks by the same means as Alternatives 2 and 3 but would add a treatment component which

may serve to reduce the mobility of the contaminants. The No Action alternative is not considered further in this analysis since it would not satisfy this threshold criteria.

Compliance with ARARs

Compliance with ARARs addresses whether a remedy will meet all applicable or relevant and appropriate Federal and State environmental laws and/or provide a basis for a waiver from any of these laws. These ARARs are divided into chemical specific, action specific, and location specific requirements.

Two specific determinations by EPA had a significant effect on the ARARs chosen for this Site. In characterizing the Site and identifying ARARs, EPA determined that the sources of contamination were mining wastes which are exempt from Resource Conservation and Recovery Act (RCRA) Subtitle C regulation under the RCRA "mining waste exclusion." The exclusion exempts from regulation "... solid waste from the extraction, beneficiation, and processing of ores and minerals...." 42 U.S.C. § 3001(b)(3)(A)(ii).

Over the last 100 years, industrial operations at the Site which have produced mining wastes include smelting, cyanide leaching, and milling. The first such operation on the Site, the Bailey smelter, began operation sometime in 1886. In 1890, the Gold and Silver Extraction Company established a mill and laboratory at the Site to process ore by the McArthur Forrest chemical cyanide extraction process, a cyanide leaching process. The Bailey smelter appears to have been converted for use by the Gold and Silver Extraction Company. In 1901, the Bailey smelter burned down. In 1902, the Colorado Zinc Company constructed a mill on the Site, which operated through 1911. In 1913, the National Radium Institute began milling operations at the Site which continued through 1918. Each of these ore and mineral processing operations generated mining wastes which may have been disposed at the Site and which in turn may have contributed to the metals contamination now found at the Site.

Mining wastes from the milling operations conducted on the Site are "beneficiation wastes", as defined at 40 C.F.R. § 261.4(b)(7), and therefore, fall within the mining waste exclusion. The wastes from the cyanide leaching process also fall within the definition of beneficiation wastes and are excluded from RCRA regulation, see 51 FR 24496, July 3, 1986 and 54 FR 36592, 36616, note 1, September 1, 1989.

Smelter wastes at the Site fall under the definition of "mineral processing wastes" and are only excluded from RCRA regulation if the wastes fall within certain specific categories. EPA has determined that the process used by the Bailey smelter was most likely primary lead smelting. Waste slag from primary

lead smelting is still excluded from RCRA regulation under the mining waste exclusion, see 55 FR 2322, January 23, 1990.

While RCRA has been determined not to be applicable, certain RCRA provisions concerning construction and maintenance of caps and closure of landfills were found to be relevant and appropriate due to the contaminated material at the Site being sufficiently similar to RCRA wastes and due to the similarity between activities contemplated at the Site and activities regulated by RCRA.

EPA also determined that the alluvial aquifer under the Site was not a potential drinking water source. The alluvial aquifer is not presently used as a drinking water source and is unlikely to be used as a drinking water source due to poor natural quality (i.e., high total dissolved solids), low yield, and its location (i.e., in an industrial area between a major rail corridor and an interstate highway). Though the aquifer is not a potential drinking water source, there is the concern that, due to the Site's proximity to the South Platte River, the aquifer has a connection with the river. Nevertheless, modeling has predicted that it is unlikely that contaminants from the Site would reach the river in detrimental concentrations.

Because the aquifer was determined not to be a potential drinking water source and it is unlikely that contaminants from the Site would affect the South Platte River, EPA determined that the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) and the Clean Water Act (CWA) water quality criteria were neither applicable nor relevant and appropriate to activities at the Site. Nonetheless, EPA identified ground water monitoring to verify the modeling predictions as a remedial action objective for the Site. Thus, ground water monitoring would be included for each alternative.

Each of the alternatives would comply with all applicable or relevant and appropriate requirements (ARARs). No chemical- or location-specific ARARs were identified for the Site. Certain provisions of the State Solid Waste Act and specific technical provisions of RCRA pertaining to closure of landfills and construction and maintenance of caps were identified as action-specific ARARs.

Alternatives 2 and 3, capping, would have to be constructed and maintained to comply with 40 CFR §§ 264.310(a)(2),(3),(4) and (b)(1),(4) and 264.117(c). These RCRA landfill closure and general closure regulations require design and construction of the cap to promote drainage, to minimize erosion or abrasion of the cap, and to accommodate settling and subsidence. In addition, measures to maintain cap integrity and prevent incompatible uses of the cap must be taken.

Alternative 5, solidification, would have to meet all the same ARARs as the capping alternatives. In addition, excavation, treatment, and redisposal of the contaminated soils would have to be done in accordance with State solid waste regulations found at 6 CCR 1007-2 § 6. These regulations establish minimum standards, closure requirements, site standards, and engineering design standards for waste impoundments used to store or dispose solid waste.

Discharge of air pollutants during implementation of any of the alternatives would be controlled to comply with the State Air Pollution requirements identified as ARARs. An evaluation of all State and Federal ARARs identified for the Site is found in Table 7-1.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the preference for a remedy that uses treatment to reduce health hazards, contaminant migration, or the quantity of contaminants at the Site.

Alternative 5, Stabilization, would be the only alternative that would provide any reduction in toxicity, mobility, or volume through treatment. Treatment in Alternative 5 may reduce the mobility of the contaminants. The degree of mobility reduction would be determined by treatability studies conducted during remedial design. However, the volume would increase and there would be no change in toxicity.

Long-Term Effectiveness

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time. This criterion includes the consideration of residual risk and the adequacy and reliability of institutional controls.

Each alternative would be expected to provide similar degrees of long-term effectiveness and permanence. Alternative 5, solidification, is the only alternative that involves treatment. Solidification may reduce the mobility of the metals, but would not reduce the toxicity and would increase the volume. The long-term effectiveness of this alternative would be dependent on the long-term integrity of the cap and preventing incompatible uses of the capped area. Therefore, maintenance of the cap and institutional controls as described for Alternatives 2 and 3 would be part of this alternative.

Alternative 4, excavation with off-site disposal, would remove all contaminated soils to a RCRA Subtitle C permitted landfill, thereby eliminating the long-term risks at the Site.

However, the long-term effectiveness of this alternative would be dependent on the reliability and operation of the landfill where the contaminated material would be disposed. While Alternative 4 would eliminate on-site risks, off-site disposal without treatment is the least preferred option under CERCLA.

Alternatives 2 and 3 would use capping and institutional controls to control or eliminate the risks at the Site. As long as the cap was maintained, the risks identified for the Site - direct contact with, and inhalation or ingestion of contaminated soils - would be eliminated. Long-term maintenance of the cap would be required. Institutional controls to prevent uses of the capped area which would be inconsistent with maintaining the integrity of the barrier would also be required.

Each of the alternatives' long-term effectiveness would be dependent on long-term maintenance of the remedy. For Alternatives 2, 3, and 5, an on-site operation and maintenance program would be required. For Alternative 4, operation and maintenance would be performed by the disposal facility. Thus, there would be no appreciable difference in the long-term effectiveness of any of the alternatives.

Short-Term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy.

Short-term effectiveness would be provided by each of the alternatives. Alternative 3, soil cap, would provide the greatest degree of short-term effectiveness. This alternative would take the least time to implement and involve the least disturbance of the contaminated materials, therefore resulting in the least risk to on-site workers and the surrounding communities. Alternative 2, clay cap, would be only slightly less effective than Alternative 3 due to a slightly longer implementation time for the clay and soil cap. Alternative 4, excavation with off-site disposal, would provide the least degree of short-term effectiveness because all the contaminated material would be disturbed, loaded on trucks, and transported for off-site disposal. Alternative 5, solidification, would be somewhat more effective than excavation with off-site disposal in the short-term due to the fact that no transportation would be involved. Also, Alternatives 4 and 5 would each require a longer time to implement than either of the capping alternatives.

Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials

and services needed to implement the chosen solution. It also includes coordination of Federal, State, and local governments to clean up the site.

Each of the alternatives, except Alternative 5, solidification, utilizes standard technologies and equipment, and would be readily technically implementable. Solidification, while a proven technology, would require additional study during the design of the remedy to maximize its implementability.

Implementation of deed restrictions for Alternatives 2, 3, and 5 would require the cooperation and approval of the owners of the Site. The owners of the Site have indicated they would cooperate in establishing deed restrictions.

Implementation of zoning for the Site pursuant to the City and County of Denver ordinances, which may be made part of Alternatives 2, 3, and 5 as an extra precautionary measure, presents uncertainty in implementation. If a change in zoning would be necessary, this would require a public process, with public notice and comment, and City Council approval.

Cost

This criterion examines costs for each remedial alternative. For comparison, capital and annual O&M costs are used to calculate a present worth cost for each alternative. The costs are as follows:

Alternative 1 - No Action	\$ 174,300
Alternative 2 - Clay Cap	\$ 2,656,000
Alternative 3 - Soil Cap	\$ 1,701,900
Alternative 4 - Excavation with Off-Site Disposal	\$10,392,200
Alternative 5 - Solidification	\$ 9,912,000

State Acceptance

The State of Colorado, through the Colorado Department of Health (CDH), has had an active role in the Focused Feasibility Study (FFS), selection of ARARs, and the remedy selection process. CDH was provided the opportunity to comment on the FFS document and the proposed plan, and attended the public meeting held to inform the public of the proposed plan. The State has concurred on EPA's selection of Alternative 3, soil cap.

Community Acceptance

Community input on the alternatives for remedial action at OU 9 was solicited by EPA during the public comment period from August 2, 1991 to October 3, 1991. Comments were received from the property owner, a vicinity property owner, and the City and

County of Denver. The property owner generally showed support for the soil cap remedy, while the vicinity property owner and the City and County of Denver supported Alternative 4, excavation with off-site disposal. Responses to all comments are found in the attached Responsiveness Summary.

IX. SELECTED REMEDY

After consideration of the statutory requirements of CERCLA, the detailed analysis of alternatives, and public comments, EPA has selected capping the contamination with a protective soil cover and existing structures, and implementation of institutional actions (Alternative 3) as the remedy for OU 9 of the Denver Radium Site. This remedy is made up of the following components:

The cap will be a multi-media cap utilizing the existing concrete floor of the brick plant and the asphalt parking lot in concert with a backfilled soil cap. The concrete floor will be inspected and repaired, if necessary. The asphalt parking lot will be upgraded to minimize future maintenance costs by using geotextile fabric and an additional six-inch layer of asphalt. The third component of the cap is the backfilled soil cap to be placed over the contaminated soil not already covered by the concrete floor or asphalt parking lot. Before the soil cap can be placed the pit created by the remedial action for OU 4 and 5 will be backfilled with soil from off-site. The ground will then be graded and contoured to provide appropriate drainage to minimize erosion and compacted to form the foundation for the cap. Contaminated soils will not be moved or used during the grading and contouring.

Of the 4.8 acres of soils with contamination above the action levels, the soil cap will cover approximately 3.7 acres. The soil cap will include a minimum of two feet of fill including six inches of soil which is adequate to support shallow rooted plants. The outliers to the north of the large area of contamination will remain in place and be covered with at least two feet of clean soil. The outliers to the south of the large area of contamination are already covered by at least two feet of clean soil and will remain in place without additional cover.

The cap will be designed and constructed so as to comply with the specific requirements of RCRA and the State Solid Waste Act which were found to be relevant and appropriate, as shown in Table 10-1. In particular, the cap will be designed and constructed to function with minimum maintenance, to promote drainage, to accommodate settling and subsidence so that the cover's integrity is maintained, to minimize erosion or abrasion of the cover, and to provide a two foot final cover over any contaminated soils.

In addition, appropriate measures will be implemented during construction of the cap to control fugitive dusts to assure compliance with the provisions of the Colorado Air Quality Control Act identified as ARARs.

Following construction of the cap, long-term maintenance, ground water monitoring and institutional controls will be instituted. The long-term maintenance will consist of a plan for periodic inspections to assure the integrity of the cap with contingencies for repair if needed. These inspections will also be used to assure that the institutional controls are effectively controlling uses of the capped areas.

Monitoring of ground water down-gradient of the Site will be conducted periodically to verify that contamination does not reach the South Platte River in detrimental concentrations. The monitoring program will be developed during remedial design.

Institutional controls will consist, at a minimum, of the placement of deed restrictions on the Site to prevent use of the Site for non-industrial/commercial purposes and to prevent uses of the capped area that could compromise the integrity of the cap. EPA will allow the capped area to be used as long as that use does not threaten the integrity of the cap. EPA will also allow the cap to be dug into, such as for a foundation, as long as proper precautions were taken and the integrity of the cap was restored. Any soils removed from the cap or from under the cap will need to be sampled. If sampling shows that such soils are RCRA characteristic, EPA will require that such soils be taken off-site and disposed in a RCRA Subtitle C facility. The deed restrictions will be established such that subsequent purchasers of the Site are bound by the provisions of the restrictions. The Site owners have indicated they will cooperate with the EPA on placement of deed restrictions on the Site.

As extra precautionary measures, EPA will require the deed restrictions to include a prohibition on placement of any wells on the Site for the purpose of supplying drinking water and will present to the City and County of Denver a proposal to zone the Site to control uses of the capped portions of the Site. EPA is presently working, and will continue to work with the City and County of Denver and the Site owners on developing a proposal to zone the Site under present City ordinances. The intent of such a proposal will be to establish a formalized procedure whereby proposed uses of the capped area which could threaten the integrity of the cap will be reported to the City and/or EPA, and/or the State for review. The exact details of this proposal and the roles of the City, EPA, the owners of the Site, and the State are yet to be determined. If a zoning proposal can be agreed upon, presented to the City Council, and approved, such zoning may be used in concert with the deed restrictions, or, if EPA determines that the zoning is adequate and effective, EPA may

allow the deed restrictions to be removed.

Because this alternative will result in contaminants remaining on Site, CERCLA requires that the Site be reviewed at least every five years to assure the protectiveness of the remedy. The estimated implementation time for construction of the cap is three weeks. EPA's selection of this alternative assumes that deed restrictions and/or zoning will effectively and reliably control uses of the cap. EPA will closely monitor the Site to verify that these assumptions are true. Should experience show that the institutional controls are not effective and reliable, EPA will reconsider the remedy.

Some modifications or refinements may be made to the remedy during remedial design and construction. Such modifications or refinements, in general, would reflect results of the engineering design process. The estimated cost for the selected remedy is \$1,701,900. Table 9-1 shows the detailed cost summary for the selected remedy.

Based on the findings in the Baseline Risk Assessment, the remedial action objectives for this Site are the following:

- 1) Prevent inhalation or ingestion of, and direct contact with soils having concentrations of arsenic, lead, and zinc in excess of the action levels, i.e., 79 ppm, 1,000 ppm, and 17,000 ppm, respectively; and
- 2) Ground water down gradient from the Site will be monitored to verify the modeling predictions that contaminants from the Site will not degrade the South Platte River.

Attainment of these remedial action goals will provide protectiveness of human health and the environment.

X. STATUTORY DETERMINATIONS

The selected remedy meets the statutory requirements of Section 121 of CERCLA. The statute requires that remedial actions undertaken at Superfund sites be protective of human health and the environment. The statute also mandates that the selected remedy comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. In addition, the selected remedy must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The statute also includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances as their principal element. The following sections describe how

TABLE 9 - 1
Capping with Asphalt, Concrete and Soil
Construction Costs (1991 Start)

Description	Basis of Estimate		Annual Amount ¹
	Qty	Rate/Units	
Semi-annual Groundwater Monitoring			
1. Inspection and Water Sampling	2	\$35.00/hr	
2. Health & Safety Monitoring	1	\$100.00/day	
3. Laboratory Analyses	4	\$400.00/ea	
4. Report	1	\$65.00/hr	
Well Maintenance	5%	\$5,000/Well	
Cap and Site			
1. Inspection	1	\$80.00/hr	
2. Repairs	5%	\$1,036,800	
Contingency	5%		
Total Annual O&M cost Present Worth of O&M Cost ²			
Five-Year Reviews Present Worth of Five-Year Reviews	5	\$8,000/ea	
TOTAL CONSTRUCTION COST			
TOTAL ALTERNATIVE PRESENT VALUE			

¹ Rounded to the nearest \$100

² Present worth analysis for 30 years at present worth discount rate of 5%

TABLE 9 - 1 (continued)
Capping with Asphalt, Concrete and Soil
Construction Costs (1991 Start)

Description	Basis of Estimate		Annual Amount ¹
	Qty	Rate/Units	
Site Preparation			
Parking Area	500 yds. ²	\$10.00/yd. ²	\$5,000
Equipment Storage Area	500 yds. ²	\$10.00/yd. ²	\$5,000
Air Monitoring Stations	3	\$10,000 ea.	\$30,000
Support Facilities			
Office Trailers	2	\$10,000 ea.	\$20,000
Decontamination trailer	1	\$25,000 ea.	\$25,000
Capping			
Site Clearing	3.7 acres	\$1,300/acre	\$4,800
Subgrade Preparation	15,000 yds. ²	\$15.00/yds. ²	
Geotextile - Material & Install	5,000 yds. ²	\$25.00	\$125,000
Asphalt	1,000 yds. ²	\$15.00/yds. ²	\$15,000
Fill	30,000 yds. ³	\$8.50/yds. ²	\$255,000
Top Soil Layer	2,000 yds. ³	\$30.00/yds. ³	\$60,000
Layering, Grading, Compacting	40 hrs.	\$300.00/hr. ³	\$12,000
Revegetation	3.7 acres	\$11,000/acre	\$40,700
Total Direct Construction Costs (TDCC)			\$597,500
TOTAL CONSTRUCTION COSTS			

¹ Rounded to the nearest \$100

the selected remedy addresses these statutory provisions.

Protection of Human Health and the Environment

The remedy selected for metals-contaminated soils at the Robco Site protects human health and the environment by capping the contaminated soils, monitoring ground water down-gradient from the Site, and using deed restrictions to limit access to and uses of the capped area. Capping and deed restrictions will control or eliminate the risks from direct contact with, or inhalation or ingestion of the contaminated soils. Ground water monitoring will serve to verify the modeling predictions that no contaminated groundwater from the Site will reach the South Platte River in detrimental concentrations.

As extra precautionary measures, institutional controls to limit future use of groundwater will be instituted and the use of the City and County of Denver's zoning authority will be pursued to prevent uses of the Site that would threaten the integrity of the capped area.

Implementation of the selected remedy will not pose any unacceptable short-term risks or cross-media impacts.

Compliance with ARARs

Under Section 121(d)(1) of CERCLA, remedial actions must attain standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release at the Site. All ARARs would be met upon completion of the selected remedy at the Robco Site.

No chemical- or location-specific ARARs were identified for the Site. Certain provisions of the State Solid Waste Act and specific technical provisions of RCRA pertaining to closure of landfills were identified as action-specific ARARs. These action-specific ARARs will be met in the design and implementation of the remedy. Table 10-1 lists Federal and State ARARs for the selected remedy.

Cost-Effectiveness

The selected remedy is cost-effective in mitigating the risks posed at the Site by metals-contaminated soils. Section 300.430(f)(ii)(D) of the NCP requires EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria: protection of human health and the environment and attainment of ARARs, against three additional balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective.

TABLE 10-1
Applicable or Relevant and Appropriate Requirements (ARARs)

Federal
Action Specific

Standard, Requirement, Criteria, or Limitation	Description	Applicable?/ Relevant and Appropriate?	Comment
CLEAN AIR ACT, 42 USC §§ 7401-7642			
National Ambient Air Quality Standards, 40 CFR 50.	Establishes air quality standards for regulated air pollutants.	Applicable	NAAQS would be applicable to the extent that the implementation of the chosen alternative would impact the ambient air quality.

State
Action Specific ARARs

Standard, Requirement, Criteria, or Limitation	Description	Applicable?/ Relevant and Appropriate?	Comment
Colorado Air Quality Control Act Regulation 1 Stationary, 5 CCR, 1001-3 Reg. 1, § III-D2 Subparts a,b,c, e,f,g,h, and i.	Regulates stationary sources.	Applicable	Applicable to construction activities to implement the capping remedy.
Colorado Air Quality Control Act Regulation 1 Stationary, 5 CCR, 1001-10 Reg. 8, § VI.	Sets forth emission control standards for hazardous air pollutants.	Applicable	Applicable to construction activities to implement the capping remedy.
Colorado Air Quality Control Act Regulation 3 5 CCR 1001-5, Reg. 3, § IV. D	Stationary emission source cannot interfere with attainment and maintenance of any National or State AAQS.	Applicable	Applicable to construction activities to implement the capping remedy.
Colorado Air Quality Control Act Regulation 12 5 CCR 1001-14, Reg. 12	Controls on emissions from diesel vehicles.	Applicable	Applicable to construction activities to implement the capping remedy.

**Table 10-1(Cont.)
ARARS**

Standard, Requirement, Criteria, or Limitation	Description	Applicable?/ Relevant and Appropriate?	Comment
Hazardous Waste Regulation, Capping, 6 CCR 1007-3 § 264.310(a)(2),(3),(4) and (b)(1),(4). Landfill closure with waste in place.	Design and construct cap to promote drainage, to minimize erosion or abrasion of the cap, accommodate settling and subsidence, and maintain cap integrity.	Relevant and Appropriate	Contaminated soils to be capped are similar to RCRA wastes and capping is similar to capping a RCRA landfill.
Hazardous Waste Regulations, Capping, 6 CCR 1007-3 § 264.117(c). Closure.	Restrict post-closure use of property as necessary to prevent damage to cap.	Relevant and Appropriate	Contaminated soils to be capped are similar to RCRA wastes and capping is similar to capping a RCRA landfill.
Hazardous Waste Disposal Siting Requirements, 6 CCR 1007-2 Part 2, §§ 2.4.1-2.4.5.	Design facility to prevent adverse effects on ground water, surface water, air quality, public health, and the environment.	Relevant and Appropriate	Contaminated soils are similar to RCRA wastes and the facility is similar to a landfill where wastes are to be left in-place.
Hazardous Waste Disposal Siting Requirements, 6 CCR 1007-2 Part 2, §§ 2.4.9-2.4.10.	Monitor ground water, surface water, and provide quality control during construction.	Relevant and Appropriate	Contaminated soils are similar to RCRA wastes and the facility is similar to a landfill where wastes are to be left in-place.
Hazardous Waste Disposal Siting Requirement, 6 CCR 1007-2 Part 2, § 2.4.8.	Close facility to assure prevention of long-term adverse effects.	Relevant and Appropriate	Contaminated soils are similar to RCRA wastes and the facility is similar to a landfill where wastes are to be left in-place.
Hazardous Waste Disposal Siting Requirements, 6 CCR 1007-3 § 264.18(b).	Construct Run-on and Run-off control systems capable of handling peak discharge of a 100-year storm.	Relevant and Appropriate	Contaminated soils are similar to RCRA wastes and the facility is similar to a landfill where wastes are to be left in-place.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.1.1.	Site topography shall minimize climatic influence upon the facility.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.1.5.	Facilities will make use of favorable geologic conditions to isolate waste.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.2.2.	Permanent surface water diversion structures.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.

**Table 10-1(Cont.)
ARARS**

Standard, Requirement, Criteria, or Limitation	Description	Applicable?/ Relevant and Appropriate?	Comment
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.2.3.	Geologic Hazards shall not prevent compliance.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.2.4.	Groundwater monitoring wells designed to code.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.2.6.	Two foot final cover.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Standards for new facilities, 6 CCR 1007-2 § 4.2.7.	Water available to prevent soils from blowing.	Relevant and Appropriate	Contaminated soils are solid wastes but this is not a new facility.
Solid Waste Regulations Minimum standards for new and existing facilities, Surface water control, 6 CCR 1007-2 § 2.1.4.	Provide surface drainage to prevent ponding, erosion, water and air pollution. Compacted fill material will be provided as well as adequate cover to minimize nuisance conditions.	Applicable	Contaminated soils are solid wastes.

The selected remedy provides the best overall effectiveness of all alternatives considered proportional to its cost. All the alternatives meet the threshold criteria of protecting human health and the environment and attaining ARARs. The preferred alternative will be the most effective alternative in the short-term. Each of the alternatives are similar in terms of long-term effectiveness. Only Alternative 5, solidification, involves any treatment. Solidification is expected to reduce the mobility of the contaminants in the soil. However, in terms of cost-effectiveness, solidification would cost \$9.9 million, when the selected alternative, soil capping, would provide similar protectiveness for \$1.7 million, the lowest cost of all the alternatives except no-action, and one-fifth of the cost of solidification. Therefore, while treatment is not a component of the preferred alternative, the selected remedy provides the best overall effectiveness of all alternatives considered proportional to its cost.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Techniques) to the Maximum Extent Practicable

EPA has determined that the selected remedy for OU 9 represents the maximum extent to which permanent solutions and technologies can be utilized in a cost-effective manner to remediate metals-contaminated soils at the Site.

Of those alternatives that are protective of human health and the environment and comply with ARARs, the selected remedy will provide the best balance in terms of the five primary balancing criteria and the two modifying criteria. The selected remedy is the lowest in cost, provides the best short-term effectiveness, and is the remedy preferred by the State and the owners of the Site. Each of the alternatives provides a similar degree of long-term effectiveness and implementability. Alternative 4, excavation with off-site disposal, is preferred by the City and County of Denver and a vicinity land owner. However, off-site disposal without treatment is the least preferred option under CERCLA. Alternative 5, solidification, is the only alternative that uses treatment to reduce toxicity, mobility, or volume of the contaminants. However, this treatment will only reduce mobility, will not change toxicity, will increase the volume of contaminated soil and will cost 5 times more than the preferred option. Alternative 2, clay cap, is similar to the preferred option. However, the clay cap will cost approximately \$1.0 million more to install and provide no more protectiveness considering the risks at the Site.

The State of Colorado concurs with the selected remedy. The Proposed Plan for the Robco Site was released for public comment in August 1991. The Proposed Plan identified Alternative 3, soil

cap, as the preferred remedy. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, EPA determined that no significant change to the remedy originally identified in the Proposed Plan was necessary.

Preference for Treatment as a Principal Element

Treatment of the principal threats at the Site is not a component of the selected remedy. Therefore, this remedy does not satisfy the statutory preference for treatment. While treatment may reduce the mobility of the contaminants, there would be no significant increase in protectiveness to human health and the environment over the selected capping remedy.

Denver Radium Site, Operable Unit 9
Denver, Colorado
Responsiveness Summary

A. OVERVIEW

When the Proposed Plan was issued, Alternative 3, a soil cap with institutional controls was presented as the preferred alternative for Operable Unit 9 (OU 9) of the Denver Radium Superfund site. The Proposed Plan also solicited comments on four other alternatives. The Record of Decision selects Alternative 3, a soil cap with institutional controls, as the remedy for contaminated soils at the site.

Judging by comments received during the public comment period, the City and County of Denver and an adjacent property owner, the Regional Transportation District (RTD), favor an excavation with off-site disposal remedy. The property owner, Robinson Brick Company (Robco), generally supports EPA's Proposed Plan for remediation of metals contamination with the implementation of appropriate institutional controls. The Colorado Department of Health (CDH) worked closely with EPA in developing the Focused Feasibility Study (FFS) and Proposed Plan. As a result, CDH did not submit formal comments during the public comment period.

These sections follow:

- * Background of Community Involvement
- * Summary of Comments Received during Public Comment Period and Agency Responses

B. BACKGROUND ON COMMUNITY INVOLVEMENT

Sections 113(k)(2)(B)(i-v) and 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) require that the U.S. Environmental Protection Agency (EPA) keep the community informed and encourage them to participate in the decision-making process in selecting a remedy for a Superfund site. At a minimum, CERCLA requires (1) notice to potentially affected persons and the public, (2) a reasonable opportunity to comment, (3) an opportunity for a public hearing, (4) a response to each significant category of comment submitted, and (5) a statement of the basis and purpose of the selected action.

This section describes the specific community participation activities that occurred in the process of selecting a remedy for OU 9. This responsiveness summary fulfills one of the key public participation requirements of CERCLA by incorporating a response to each comment submitted by the public.

In September of 1988, during the course of the radium cleanup at the site, metals contamination was discovered. The community was informed of this development in a March 1989 Denver Radium Information Update. An investigation to characterize the nature and extent of the metals contamination was conducted in 1989 and 1990. That investigation resulted in the FFS which outlines a number of alternatives for the cleanup of the metals-contaminated soils at the site.

The FFS and the Proposed Plan for OU 9 were released to the public for comment on August 2, 1991. These two documents were made available to the public in the Administrative Record maintained at the Central Branch of the Denver Public Library and at the EPA Region VIII Superfund Records Center in Denver, Colorado. The notice of availability for the FFS, the Proposed Plan, and other documents in the Administrative Record was published in the Denver Post on August 2, 1991. A public meeting was held in Denver on August 14, 1991. At this meeting, the public was invited to ask questions of EPA and CDH representatives concerning the site and the remedial actions under consideration. A transcript of the meeting was prepared and placed in the Administrative Record.

C. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

Comments raised during the OU 9 public comment period, on the draft FFS and Proposed Plan, are summarized briefly below. The comment period was held from August 2, 1991 to October 3, 1991. The comments are categorized by relevant topics.

Focused Feasibility Study

Robco had several comments on the Focused Feasibility Study. Those comments and EPA's responses are summarized below:

- 1) It was recommended that some of the information in the Site History section of the FFS, especially regarding the procedures of past operations and the activities of the National Radium Institute (NRI), be deleted as unnecessary.

EPA Response: The metals contamination found at the Site may have resulted from any of the mineral processing operations known to have occurred on the Site. Therefore, EPA chose to include as much information about past operations and activities at the site as possible to give a complete picture of the site history.

- 2) Several concerns were raised about the section of the FFS regarding the Nature and Extent of Contamination. Generally it was recommended that the information be reorganized and more clearly integrated with information in other sections of the FFS.

EPA Response: Extensive revisions were made to this section prior to finalization of the FFS. The revisions addressed the concerns raised by the commentor.

- 3) Containment was identified as a general response action and capping was identified as a remedial technology type that should have been included in Table 2-2.

EPA Response: Containment and capping were both included in Table 2-2 in the final version of the FFS.

- 4) It was recommended that the discussion on institutional controls be reorganized within the text. Also, the details of specific institutional controls and how they would meet the goals and objectives of the remedial action should be discussed.

EPA Response: The discussion on institutional controls was reorganized within the text of the report. The FFS was not modified to include details on institutional controls. However, the Record of Decision for OU 9 (ROD) identifies deed restrictions as the primary institutional control to be used at the Site. EPA will also continue to work with the City and County of Denver, the State, and Robco to identify and implement other institutional controls at the Site, such as zoning under City ordinance. The specific details of the deed restrictions and any other potential institutional control will be determined during remedial design in cooperation with the State, City and County of Denver, and Robco, as appropriate.

- 5) Since ground water was not established as a pathway of concern, it was recommended that the FFS be modified to indicate that the potential migration of contaminants in ground water is not an issue which should affect the Record of Decision.

EPA Response: EPA determined that ground water was not a pathway of concern, in part, based on the modeling predictions that contaminated ground water from the Site would not reach the South Platte River in detrimental concentrations. In order for the remedy to be protective, EPA determined that monitoring of the ground water downgradient of the Site should be done to

verify the modeling predictions. If monitoring shows that contamination is migrating to the River in detrimental concentrations, EPA will reconsider its determination that the ground water is not a pathway of concern and may reconsider the remedy.

Applicable or Relevant and Appropriate Requirements

Robco also had several comments on the Applicable or Relevant and Appropriate Requirements (ARARs) for the site. The comments and EPA's responses are summarized below.

- 1) The assertion that 6 CCR 1007-2 §§ 2.4.1 - 2.4.5 are relevant and appropriate is incorrect since ground water has not been identified as a pathway of concern; the only water quality issue is degradation of the Platte River; and, the impact on the highway property is irrelevant.

EPA Response: The standards in 6 CCR 1007-2 §§ 2.4.1-2.4.5 are general standards for the closure of solid waste sites and facilities. EPA determined that these standards would be ARARs for any alternative which involved the disposal of solid wastes. In particular, EPA felt that the proposal to dispose the treated waste under the solidification alternative would involve the disposal of solid waste and therefore these standards would be ARARs for that proposal. These standards were not identified as ARARs for the selected remedy.

- 2) 6 CCR 1007-2 Part 2 §§ 2.4.9 - 2.4.10 and Part 2 § 2.4.8 were each identified as relevant and appropriate. The property owner was unable to find these citations and therefore can't comment on their designation as relevant and appropriate.

EPA Response: These regulations provide general narrative standards for the design, construction, and closure of a hazardous waste disposal site and facility. These standards are similar to the RCRA requirements which were found to be relevant and appropriate to activities at the Site.

- 3) The owner of the property found troubling the determination that 6 CCR 1007-3 § 264.117 (c) is relevant and appropriate. The property owner will not accept a regulation requiring permission from EPA or any other agency to develop the property for an appropriate use and a regulatory determination that any incursion into a cap is 'necessary'.

EPA Response: This regulation requires post-closure use of the property to be restricted as necessary to prevent damage to the cap. In order for the selected remedy to be operational, functional, and protective, non-industrial/commercial uses of the Site must be prevented and the integrity of the cap must be maintained. EPA will work with Robco to design restrictions for the Site which are protective of the remedy and meet Robco's needs. If such restrictions cannot be agreed upon, EPA may have to reconsider the selected remedy.

- 4) The property owner understands that any capping alternative will impact the manner in which future construction activities occur on the property in two respects: (1) compliance with 29 CFR Part 1910 will be necessary, and (2) at the completion of any construction, the cap will have to be repaired or replaced to the extent it was disturbed by the construction activities. No additional constraints beyond those that would apply in any case are necessary to protect public health or the environment. Any additional constraint would be deemed an impermissible and compensable taking.

EPA Response: EPA determines which remedial activities to conduct at a Site based on whether such activity is necessary to protect human health and the environment. Any such determination would not rise to the level of a taking. However, EPA will work with Robco to reduce the impact of any restrictions to the extent possible.

In addition to the comments of Robco, RTD, a vicinity property owner, had several comments on ARARs. Those comments and EPA's responses are summarized below.

- 1) It was suggested that the preferred alternative, capping of contaminated soils, is inconsistent with ARARs chosen for Operable Units (OUs) IV/V since a cap would prevent the excavation and off-site disposal of identified radiological contaminants. The vicinity property owner states, "There is still Radium-226 contaminated soil that exceeds the UMTRAP standard along with Thorium-230 contaminated soil that exceeds the established UNC removal criteria at the site. The proposed remedial action of leaving the metals contamination on site and capping the area will not fulfill the ROD for OU's IV/V."

EPA Response: Radium and thorium deposits which occur below the water table were left in place. The decision to leave this material in place is consistent with the

Department of Energy's (DOE) Protocol for Excavation of Thorium-230. (See the Generic Protocol for Excavation of Thorium-230, DOE, January 25, 1989.) The decision is also consistent with the criteria for applying supplemental standards, set forth in 40 CFR 192.21(c). The regulation states that remedial action will generally not be necessary where residual radioactive materials have been placed semi-permanently in a location where site-specific factors limit their hazard and from which they are costly to remove, or where only minor quantities of residual radioactive materials are involved. To the degree that leaving these radium deposits in place constitutes a significant change in the remedy for OU 4 and 5, EPA will publish an explanation of significant differences.

- 2) The Record of Decision for the remediation of radiologic contamination at this site identified 40 CFR 192 as an ARAR. It was suggested that 40 CFR 192.32, Subpart D, and the ground water protection standards contained therein, be identified as an ARAR for OU 9.

EPA Response: The standards for uranium and thorium mill tailings, 40 CFR 192, were identified as relevant and appropriate for operable units 4 and 5 of the Denver Radium Site. The basis for this determination was that radium is similar to uranium and thorium and that radium processing sites were similar to the uranium and thorium processing sites covered by 40 CFR 192. The contaminants at OU 9 are not similar to uranium and thorium and the source of the OU 9 contaminants may or may not be the radium processing which occurred at the Site. As a result, the requirements in 40 CFR 192 are not relevant and appropriate to activities conducted under OU 9.

- 3) RTD disagrees with EPA's determination that the metals-contaminated soils at the site are exempt from RCRA regulations under the mining waste exclusion. Research revealed that some of the waste at the site resulted from gold and silver extraction by use of the McArthur Forrest cyanide process. RTD asserts that the use of this process renders the mining waste exclusion inapplicable.

EPA Response: EPA has specifically determined that wastes from cyanide leaching processes fall within the definition of beneficiation wastes and are exempt from RCRA under the mining waste exemption, see 51 FR 24496 (July 3, 1986) and 54 FR 36592, 36616, note 1 (September 1, 1989). Therefore, the fact that wastes found on-site may have come from a cyanide leaching

process does not change EPA's determination that all mining wastes found at the Site are RCRA exempt under the mining waste exclusion.

- 4) It is suggested that the State Groundwater Human Health, Secondary Drinking Water, and Agricultural Standards are relevant and appropriate since the standards will be applicable when the aquifer is classified.

EPA Response: Until a regulation is promulgated, it is not considered to be either applicable or relevant and appropriate. At most, the State Groundwater Human Health, Secondary Drinking Water, and Agricultural Standards are regulations to be considered (TBCs). Given that the ground water at the Site has not been identified as a pathway of concern, EPA did not consider these regulations.

- 5) The Record of Decision for OU IV/V stated that ground water remedial actions would be conducted to be consistent with the proposed requirements of the ground water protection provisions of 40 CFR 192, Part B. The commentor identified two on-site wells and two off-site wells where these standards are not met. Further, the commentor states that the standards will not be met since radionuclides remaining in the soils on site will continue to degrade ground water quality.

EPA Response: 105,555 tons of radiologically-contaminated materials were excavated from OU IV/V for off-site disposal. The radionuclides remaining in the soils on site are below the ground water table consistent with the DOE protocol. It is anticipated that with the source of the radiological contamination removed, contamination in the ground water will naturally attenuate. The wells where contamination has been identified will continue to be monitored to verify attenuation of the contaminants. Ground water at and down-gradient from the site will also continue to be monitored to verify that any migration of contaminated ground water will not degrade water quality in the South Platte River.

- 6) It is suggested that MCLs be identified as ARARs on the site.

EPA Response: Because the aquifer was determined not to be a potential drinking water source and it is unlikely that contaminants from the Site would affect the South Platte River, EPA determined that the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels

(MCLs) and the Clean Water Act (CWA) water quality criteria were neither applicable nor relevant and appropriate to activities at the Site. Nonetheless, EPA will require, as an additional protective measure, and to verify modeling predictions, that the selected remedy include ground water monitoring.

Ground Water

EPA received several comments concerning ground water from both RTD and the City and County of Denver. The comments of RTD and EPA's responses are summarized below.

- 1) The commentor states that, "The results of the VHS instantaneous mixing predictions for cadmium; the groundwater analysis obtained off-site; the fact that the contaminants are leachable; the fact that cadmium can accumulate in sediments; and that the uncharacterized paleochannel provides a preferred pathway for migration, all mandate that the groundwater and source soils must be addressed in the remedy selection."

EPA Response: Ground water modeling indicates that it is unlikely that any migration of ground water will degrade the water quality of the South Platte River. Modeling data shows that the site is presently contributing little to the metals load carried by the South Platte River. None of the mixing zone predictions are above the ambient criteria and most are significantly lower. Cadmium migrating from the site has the potential to contribute to highly localized exceedances of the chronic criterion for protection of aquatic biota in the instantaneous mixing zone. Ground water monitoring will be used to verify the modeling predictions that contamination is not reaching the River in detrimental concentrations. If monitoring shows that contamination is migrating to the River in detrimental concentrations, EPA will reconsider the remedy.

- 2) The commentor has also suggested that off-site ground water contamination has not been completely investigated.

EPA Response: During the remedial design process, following the Record of Decision, EPA will develop a sampling and analysis plan for ground water monitoring. At that time, additional ground water monitoring wells will be developed, as needed, to better characterize ground water down-gradient from the Site.

The comments of the City and County of Denver concerning groundwater and EPA's responses are summarized below.

- 1) The City and County of Denver suggests that sampling the Platte River would be useful to validate EPA's modeling which shows that metals contaminated ground water from the site will not have an adverse impact on the water quality in the river.

EPA Response: EPA will consider including sampling of the South Platte River in developing the ground water sampling and analysis plan.

- 2) It is suggested that if there is no identifiable trend of decrease in metals contamination in the ground water after five years, remediation of the property should be readdressed.

EPA Response: The metals contaminated ground water only becomes a risk concern if this ground water moves to the South Platte River in concentrations which would degrade the Platte. EPA will reconsider the selected remedy if it is shown that ground water contamination is degrading the water quality of the South Platte River.

- 3) Since the preferred alternative does not reduce the toxicity, mobility, or volume of the metals contaminated soils, it is suggested that monitoring of the ground water will be required in perpetuity or until contamination levels decline.

EPA Response: EPA will require ground water monitoring as long as is necessary to assure that the remedy is protective.

Institutional Controls

Issues regarding the implementation of institutional controls were raised by the property owner, the City and County of Denver, and at the public meeting. Comments made by the City and County of Denver and EPA's responses are summarized below.

- 1) The City and County of Denver commented that there is no permanent and effective management control mechanism which would assure no public contact with metals contaminated material in the future.

EPA Response: Institutional Controls are an integral part of the selected remedy. EPA is working with Robco

to establish deed restrictions on the Site to prevent use of the Site for non-industrial/commercial purposes, to prevent uses of the capped portions of the Site that could compromise the integrity of the cap, and to prohibit the placement of any wells on the Site for the purpose of supplying drinking water. As an extra precautionary measure, EPA is working with the State, City and County of Denver, and Robco to develop and present to the City and County of Denver a proposal to zone the Site to control uses of the capped portions of the Site.

In addition, EPA will be critically reviewing the reliability and effectiveness of any controls used at the Site as part of its duty to assure that the remedy remains protective. If this review shows that controls are not reliable and effective, EPA will reconsider the remedy.

- 2) The City and County also questioned who would have long-term management responsibility for the site if the property is abandoned or property taxes are not paid.

EPA Response: When wastes are left on-site, EPA is required to review conditions at the Site at least every five years to assure that the remedy remains protective. In addition, the State and EPA will be responsible for assuring that the remedy is operated and maintained.

- 3) The comment was made that Special Construction Zone criteria and how such criteria would be administered were not established in the Proposed Plan. Rezoning of the site as a Special Construction Zone would require public notice and City Council approval. Since it is not known that such approval would be forthcoming, the Special Construction Zone should not be relied upon in the Record of Decision. The City also raised the concern that there would be ongoing costs associated with administering a Special Construction Zone and that these costs should not be passed on to local governments.

EPA Response: EPA acknowledged in the proposed plan and in the ROD that there are uncertainties in the implementation of any zoning or rezoning on the Site. The ROD makes it clear that EPA is not relying on zoning of the Site as part of the remedy. Instead, EPA is proposing zoning as an extra precautionary measure for the remedy. EPA recognizes that additional costs may be associated with administering a Special Construction Zone. EPA will assist the City and County

of Denver with any such additional costs to the extent allowed by law.

Comments concerning institutional controls made by Robco and EPA's responses are summarized below.

- 1) Robco commented that they are amenable to deed restrictions to memorialize requisite constraints on development of the property. Robco further commented that implementation of a Special Construction Zone may have merit.

EPA Response: If a zoning proposal can be agreed upon, presented to the City Council, and approved, such zoning may be used in concert with deed restrictions. If EPA determines that the zoning is adequate and effective, EPA may allow the deed restrictions to be removed.

Two questions, raised by a representative of Robco, were addressed to EPA during the public meeting. EPA's responses to those questions are summarized below.

- 1) The commentator questioned exactly how ground water use at the site would be limited.

EPA Response: EPA replied that limiting the use of ground water would require the cooperation of the property owner to put a deed restriction on the property to ensure that no drinking-water supply wells would be established on the Site.

- 2) The commentator also questioned if the Special Construction Zone was being considered as part of the remedy.

EPA Response: At the time of the public meeting, EPA responded that it would be working with the City and County of Denver to determine if establishment of a Special Construction Zone would be an implementable institutional control. Since that meeting, EPA has met several times with representatives of the City and County of Denver on this issue. EPA will continue to work with Denver and the other parties at the Site to try to establish the most effective combination of institutional controls to assure that the remedy remains protective.

Remedy Selection

Each of the interested parties - Robco, RTD, and the City and County of Denver had comments on the selection of the remedy

at the site. The comments of Robco and EPA's responses are summarized below.

- 1) Robco commented that the proposed plan does not take into account the additional costs which may be associated with the removal of underground petroleum storage tanks at the site. Additional costs could be incurred if removal of the tanks also required the excavation and subsequent disposal of any metals-contaminated soils.

EPA Response: The removal of any underground storage tanks at the site and the costs associated with such removal is the responsibility of the property owner.

- 2) Robco also suggested that future incremental costs associated with construction activities in the metals contaminated soil or with repair of the cap when incursions occur should be included as part of the remedial action response cost.

EPA Response: Any incremental costs associated with construction activities in the metals-contaminated soil is the responsibility of the property owner and/or the developer of the property.

RTD also commented on remedy selection at the site. Their comments and EPA's responses are summarized below.

- 1) The commentator states that the EPA-preferred remedy does not meet the threshold criteria of complying with ARARs or protecting the environment. Nor does the preferred alternative reduce toxicity, mobility, or volume.

EPA Response: The selected remedy is protective of the environment and complies with all applicable or relevant and appropriate regulations. The environmental threat at the site comes from the potential for contaminants to migrate via ground water to the South Platte river. EPA's modeling shows that contaminants will not migrate from the Site to the South Platte in detrimental concentrations. EPA has included ground water monitoring as part of the selected remedy specifically to verify that the modeling predictions are correct. If the monitoring shows that the modeling predictions were incorrect, EPA will reconsider the remedy.

CERCLA and the National Contingency Plan contain a preference for remedies that use treatment to reduce the toxicity, mobility, or volume of the contaminants where practicable. In this case, treatment, i.e.,

solidification, was determined to be no more effective, yet five times more costly than the selected remedy. For that reason, the treatment alternative was determined not to be practicable for this Site.

- 2) RTD supports the excavation with off-site disposal alternative stating that the mobility of the contaminants would be reduced, there would be greater long-term effectiveness and permanence, and the ARARs relating to ground water would most likely be met since the source material would be removed.

EPA Response: Excavation with off-site disposal would remove all contaminated soils to a RCRA Subtitle C permitted landfill. The inherent risks presented by these contaminants would not change. Therefore, this alternative would not reduce mobility of the contaminants. The risk would just be transferred to the off-site facility and the long-term effectiveness of this alternative would be dependent on the reliability and operation of the off-site facility. While excavation with off-site disposal would eliminate on-site risks, off-site disposal without treatment is the least preferred option under CERCLA.

The City and County of Denver's comments regarding remedy selection and EPA's responses are summarized below.

- 1) The City and County expressed concern about the inclusion of an existing structure as part of the cap for the contaminated soils. They commented that, "It is essential that existing, abandoned structures be removed because they represent an attraction to children, transients and homeless people."

EPA Response: EPA's response authority is limited by CERCLA. EPA has no authority to spend trust money demolishing the structures unless necessary to remediate a risk posed by the hazardous substances, or by pollutants or contaminants which may present an imminent and substantial danger to the public health or welfare.